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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/650,670	08/29/2003	Takuma Hara	241984US2	7771

22850 7590 10/19/2005

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EXAMINER	
ROSE, KIESHA L	

ART UNIT	PAPER NUMBER
2822	

DATE MAILED: 10/19/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

AK

Office Action Summary	Application No.	Applicant(s)	
	10/650,670	HARA ET AL.	
	Examiner	Art Unit	
	Kiesha L. Rose	2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE ____ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 July 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-8,10-15 and 20-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *12-15 and 20-25* is/are allowed.

6)☒ Claim(s) *1-3,5-8,10 and 11* is/are rejected.

7)☒ Claim(s) *4* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

This Office Action is in response to the amendment filed 20 July 2005.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-3 and 6 are rejected under 35 U.S.C. 102(b) as being anticipated by Shinobe et al. (U.S. Patent 5,793,065).

Shinobe discloses a thyristor (Figs. 15, 28C and 31) that contain a first main electrode (12), a second main electrode (11), a semiconductor base region (45) of a first conductivity type, a gate electrode (G1) provided in a trench through an insulating film (4), the trench being formed to penetrate the semiconductor base region, and a first semiconductor region (1) of a second conductivity type provided under the semiconductor base region, a second semiconductor region (54) of a first conductivity type provided under the first semiconductor region, a third semiconductor region (3) of a second conductivity type provided under the second semiconductor region (Fig. 15 #3 can be N or P) and a fourth semiconductor region (7) of a second conductivity type provided on the semiconductor base region, the first main electrode being provided on the fourth semiconductor region and the second main electrode being provided under

the third semiconductor region, a flow of a current between the first and second main electrodes when a voltage of a predetermined direction is applied between these electrodes being controllable in accordance with a voltage applied to the gate electrode, and a depleted region extending from a junction between the first and the second semiconductor regions reaching the trench, wherein a forward voltage is applied to a p-n junction formed between the first and second semiconductor regions when the voltage of the predetermined direction is applied between the first and second main electrodes and where the second semiconductor region is in contact with the trench (Fig. 28c) and the second semiconductor region is apart from the trench.

> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 8 and 10-11 are rejected under 35 U.S.C. 102(e) as being anticipated by Onishi.

Onishi discloses a semiconductor device (Fig. 3) that contains a first main electrode (38), a second main electrode (40), a first semiconductor region (39) of second conductivity type, a second semiconductor region (31b) of a first conductivity type provided on the first semiconductor region, a third semiconductor region (32d) of a second conductivity type provided on the second semiconductor region, a fourth semiconductor region (32) of a first conductivity type provided on the third semiconductor region, a fifth semiconductor region (33) of a second conductivity type provided on the fourth semiconductor region, a trench penetrating at least the third

through fifth semiconductor regions, a bottom of the trench being provided within the second semiconductor region; and a gate electrode (Gate) provided in the trench through an insulating film (34) wherein the first main electrode is provided on the fifth semiconductor region and the second main electrode is provided under the first semiconductor region, the second and the third semiconductor regions are substantially depleted and a boundary between the second semiconductor region and the third semiconductor region is in contact with a side surface of the trench. regions are depleted. The concentration of the second and third region is 3.0×10^{15} cm^3 (Column 6, lines 32-36).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 5 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shinohe in view of Onishi et al. (U.S. Patent 6,621,132).

Shinohe discloses all the limitations except for a plurality of first and second semiconductor regions or the first and second semiconductor regions arranged in an alternating arrangement. Whereas Onishi discloses a semiconductor device (Fig. 3) that contains a semiconductor base region (32d) of first conductivity type, a plurality of first semiconductor regions (31b) of a second conductivity type and a plurality of third

semiconductor regions (31a) of a first conductivity type, the second and the third semiconductor regions being arranged alternately and perpendicular to the depth direction of the trench. The first and second semiconductor regions are formed of first and second conductivity types in an alternating arrangement to increase switching speed, reduce on-resistance and to have a high breakdown voltage. (Abstract, Column 1, line 67 and Column 2, lines 1-2) Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Shinohe by incorporating a plurality of first and second semiconductor regions and have them in an alternating arrangement to increase switching speed, reduce on-resistance and to have a high breakdown voltage as taught by Onishi.

Allowable Subject Matter

Claim 4 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 12-15 and 20-25 are allowed.

The following is an examiner's statement of reasons for allowance: Claims 20-25 are allowable because prior art does not show alone or in combination along with the limitations of the independent claims such as the trench in contact with the second and third semiconductor regions.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably

accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Response to Arguments

Applicant's arguments with respect to claims 1-8,10-15 and 20-25 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kiesha L. Rose whose telephone number is 571-272-1844. The examiner can normally be reached on M-F 8:30-6:00 off 2nd Mondays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on 571-272-1852. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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